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Power Electronics Specialists Conference, PESC '94 Record., 25th Annual IEEE , June 1994
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Design and implementation of a series voltage sag compensator under practical utility conditions

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Abstract:
Voltage sags have become one of the most important power quality concerns recent years. According to survey results across the US, voltage sags and shc duration power outages account for 92% of power quality problems encounte industrial customers. Voltage sags often cause undervoltage faults in various sensitive loads and subsequently interrupt the manufacturing processes. Sucl interruptions often inflict severe losses for industries. In Taiwan, ROC, most h tech manufacturers use uninterruptible power supplies to avoid interruptions, the cost effectiveness of such an approach remains unclear. As the utility gric continues to improve the reliability of electric power, the inverter-based volta sag compensator has become a viable solution to prevent production interrup resulting from voltage sags. The existing sag compensation systems accompli fast response within a small fraction of a fundamental cycle by tracking the li voltages closely, and switch on the compensator whenever the voltage wavef deviate from the normal values. However, the utility voltages often contain transient spikes with amplitudes up to 200% resulting from switching of powe factor-correction capacitors, circuit breakers switchings, lightning strikes, and on. Such transient disturbances may trigger the sag compensator into operat its controller is very sensitive. The switching frequency of the sag compensat inverter is inadequate to compensate the narrow pulses of voltage spikes. Furthermore, the power semiconductor devices (like insulated gate bipolar transistors) of the inverter may also be damaged due to overvoltage by the s In this paper, a brief overview of power quality issues of a high-tech industry in Taiwan is provided to validate the need for ride-through technologies. A synchronous-reference-frame-based controller for the inverter-based voltage compensator is also presented. A sag detection mechanism is included in the controller for correct and prompt identification of voltage sags. Disturbances l voltage spikes are attenuated to avoid any false triggering of the compensatc overall system responds to voltage sags and restores the voltage back to bal

1.0 pu for critical loads within one-eighth to one-fourt- h of a cycle, which me
requirement of industry standards like the SEMI-F47 standard. Simulation an
laboratory test results are presented to verify the functionality of the propose
system.

Index Terms:
circuit breakers compensation invertors power capacitors power factor correction p
supply quality power system faults SEMI-F47 standard Taiwan circuit breakers swit
false triggering avoidance high-tech manufacturers industrial customers insulated ga
bipolar transistors inverter-based voltage sag compensator lightning strikes line volta
tracking manufacturing processes interruption power quality problems power semicoı
devices power-factor-correction capacitors ride-through technologies sag compensat
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10	BRS	L10	19	(slic$4 near2 subject$4) and ((support$4) near4 (system or devic$4 or apparatus)) and (imag$4 near3 position$4)	USPAT	2003/12/17 16:46			0
11	BRS	L11	1	1 and (sag near2 correct$4)	USPAT	2003/12/17 16:47			0

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12	BRS	L12	348	1 and (sag)	USPAT	2003/12/17 16:47			0
13	BRS	L13	25	12 and (support$4 near2 element$4)	USPAT	2003/12/17 16:52			0
14	BRS	L14	25	13 and (imag$4 naer3 position$4)	USPAT	2003/12/17 16:50			0
15	BRS	L15	11	14 and ((support$4) near4 (system or devic$4 or apparatus))	USPAT	2003/12/17 16:50			0
16	BRS	L17	0	16 and ((support$4) near4 (system or devic$4 or apparatus))	USPAT	2003/12/17 16:50			0
17	BRS	L16	5	13 and (imag$4 near3 position$4)	USPAT	2003/12/17 16:50			0
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19	BRS	L19	2	1 and 18	USPAT	2003/12/17 16:53			0
20	BRS	L20	206	(support$4 near4 element$4) same sag	USPAT	2003/12/17 16:57			0
21	BRS	L21	3	1 and 20	USPAT	2003/12/17 16:55			0
22	BRS	L22	99	(support$4 near4 element$4) with sag	USPAT	2003/12/17 17:19			0
23	BRS	L23	1	1 and 22	USPAT	2003/12/17 16:56			0
24	BRS	L24	67	((support$4 near4 element$4) near7 (sag))	USPAT	2003/12/17 17:00			0
25	BRS	L25	0	1 and 24	USPAT	2003/12/17 16:59			0
26	BRS	L26	78	2 and sag	USPAT	2003/12/17 17:00			0
27	BRS	L27	54	26 and element$5	USPAT	2003/12/17 17:00			0

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30	BRS	L31	1	29 and sag	USPAT	2003/12/17 17:14			0
31	BRS	L32	207939	(nuclear adj medicine or NM)	USPAT	2003/12/17 17:20			0
32	BRS	L33	12308	1 and 32	USPAT	2003/12/17 17:18			0
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37	BRS	L38	33	36 and (support$4 near4 element$4)	USPAT	2003/12/17 17:31			0
38	BRS	L39	11134	longitudinal adj position	USPAT	2003/12/17 17:31			0
39	BRS	L40	711	1 and 39	USPAT	2003/12/17 17:31			0
40	BRS	L41	65	40 and (support$4 near4 element$4)	USPAT	2003/12/17 17:31			0
41	BRS	L42	1	41 and sag	USPAT	2003/12/17 17:32			0
42	BRS	L46	26	41 and (imag$4 near4 position$4)	USPAT	2003/12/17 17:33			0